Initial Effects of Wilson Reading System on Student Reading and Spelling Achievement

by

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ABSTRACT

This study examined the effects of an intensive remedial program, Wilson Reading System (WRS), on 43 struggling readers from second to twelfth grade. The students, who attended a large southwestern urban school district, were all at least two grade levels below their peers in reading. Participants received 20 hours of WRS instruction over the course of one month as part of a WRS teacher certification course. Using the Woodcock-Johnson III Tests of Achievement, students were evaluated prior to and following their participation in the intensive summer program using five subtests (Letter-Word Identification, Reading Fluency, Spelling, Word Attack, and Spelling of Sounds) and two clusters (Basic Reading and Phoneme/Grapheme Knowledge) to assess gains in students' reading achievement. Since the intervention was delivered for such a brief period, this study was designed to provide a snapshot measure of initial reading skill gains. While a failure to perform significantly better was observed on the Letter-Word Identification, Reading Fluency, and Spelling subtests, students demonstrated significant improvement on Word Attack and Spelling of Sounds subtests following WRS instruction. Furthermore, students significantly improved on the Basic Reading and Phoneme/Grapheme Knowledge clusters. Study limitations and implications for future research and practice are discussed.

DEDICATION

This work is dedicated to two individuals who, without their love and wisdom, this endeavor would not have been possible. To my mother, Carol Grimshaw, who instilled in me as a young girl that “the sky is the limit” and has been my lifelong cheerleader. Also to my husband, Will Ashby, who has never waivered in his patience and support.

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Chapter 1

INTRODUCTION

Learning to read is one of the most significant early educational accomplishments because it provides the foundation for future learning and academic achievement. Moreover, reading has been repeatedly referred to as the single most important aspect to all educational success (Clark & Uhry, 1995; Hall & Moats, 2002; Snow, Burns, & Griffin, 1998). Many children look forward to learning to read and do so quickly, while other children experience frustrating and persistent problems in acquiring these skills regardless of their intellectual capability (Shaywitz, 2003). The 2011 National Center for Education Statistics (NCES) assessment revealed that 33% of fourth graders performed below the basic level of proficiency in reading (National Assessment of Educational Progress [NAEP], 2011), and this figure has been relatively stable in the U.S. for the last 30 years (Torgesen, 2005). Furthermore, reading is the primary problem for approximately 80% of the one million individuals receiving special education support for a learning disability (U.S. Department of Education, 2012).

There are many educational, social, and psychological disadvantages that have been associated with reading disabilities (American Academy of Pediatrics, 2009; Wilcutt & Pennington, 2000). Reading difficulties are the most common cause of academic failure and underachievement (International Dyslexia Association, 2010). Delayed development of reading skills affects vocabulary growth (Cunningham and Stanovich, 1998), alters children's attitudes and motivation to read (Oka & Paris, 1986), and leads to missed opportunities to develop comprehension strategies (Brown, Palincsar, & Purcell, 1986). Several longitudinal studies have found that children who are poor readers at the end of the first grade almost never acquire average-level reading skills by the end of elementary school

(Francis, Shaywitz, Steubing, Shaywitz, & Fletcher, 1996; Juel, 1988; Torgesen & Burgess, 1998). Moreover, once students fall notably behind in their growth of critical early reading skills, they have fewer opportunities to practice reading (Torgesen, 2002).

As students progress through grade levels, reading proficiency becomes an increasingly important means of acquiring new knowledge. Given that students who do not have sufficient reading skills are often unable to keep up with the curriculum, the educational implications of skill deficits extend beyond reading to other academic skills. Difficulties learning to read also affect students' engagement, motivation, and connections to school (Gutherie & Wigfield, 2000; Snow, Burns, & Griffin, 1998). This contributes to the gradual process of withdrawal that precedes later dropout (Finn, 1989); young people entering high school in the bottom quartile of achievement are substantially more likely than students in the top quartile to drop out of school, setting in motion a host of negative social and economic outcomes for students and their families (Torgesen et al., 2007).

The demands for high levels of literacy are rapidly accelerating in our society (Snow, Burns, & Griffin, 1998). Children who become adolescents and adults with poor basic reading skills are undoubtedly at a disadvantage in a society that is creating ever-high demands for effective reading skills within the workplace (Brynner, 2008). Adults who have very poor reading skills compose a large number of those who are high school dropouts, unemployed, living in poverty, or receiving, government assistance, and/or incarcerated (Reschly, 2010). It has been argued that mastery of literacy skills is one method of addressing the very high rate of recidivism among the prison population (Vacca, 2004).

Difficulty learning to read may lead to frustration, low self-confidence, poor self-esteem, social exclusion, and emotional problems (American Academy of

Pediatrics, 2009; Brynner, 2008; Wilcutt & Pennington, 2000). Arnold, et al. (2005) found that adolescents with significant reading problems are at a higher risk for behavioral and emotional difficulties than adolescents with typical reading ability. Moreover, there is a higher rate of psychiatric disorders among youth with reading problems (Goldston et al., 2007). Most importantly, youth with poor reading ability are more likely to experience suicidal ideation or attempts even after controlling for sociodemographic and psychiatric variables. (Daniel et al., 2006).

To prevent underachievement, educational disengagement, and psychological distress, it is important to identify appropriate interventions that effectively bolster these students' literacy needs. Thus, this study seeks to examine an intensive remedial reading intervention for students who are multiple grade levels behind their peers in encoding and decoding. The purpose of this study is to evaluate the efficacy of a highly-structured program, *Wilson Reading System (WRS)*, to significantly improve struggling students' reading achievement.

Chapter 2

LITERATURE REVIEW

In order to understand students who demonstrate delayed reading achievement and the interventions to remediate these delays, the manner in which reading and related skills are acquired should be considered.

In response to a congressional request the National Institute of Child Health and Human Development (NICHD) and the Secretary of Education convened the National Reading Panel (NRP) to "identify and summarize research literature relevant to the critical skills, environment, and early developmental interactions that are instrumental in the acquisition of beginning reading skills" (National Reading Panel [NRP], 2000). The 14 researchers, teachers, administrators, and parents comprising the NRP conducted a meta-analysis and evaluated information from regional public hearings and the National Research Council's work on Preventing Reading Difficulties in Young Children (edited by Snow, Burns, & Griffin, 1998). They identified five essential elements of reading: (a) phonemic awareness, (b) phonics, (c) oral reading fluency (d) vocabulary, and (e) comprehension (NRP, 2000).

Critical Elements of Reading

Phonemic awareness. Phonological awareness refers to the ability to perceive and manipulate the sounds that comprise the words in a person's language and often times develops before a person learns to read (Mather & Wendling, 2012; Torgesen, Wagner, Rashotte, Burgess, & Hecht, 1997). This oral language "umbrella" term manifests as the ability to rhyme words, segment or break words into syllables, and isolate and the individual sounds. For example, the word *protect* can be phonologically subdivided on different levels: /pro/ and /tEkt/ for the syllable level, /pr/ and /o/ for the onset level within its corresponding syllable, /t/ and /Ect/ for the rhyme level within its syllable, and lastly the word can be phonologically

divided into the individual sounds themselves /p/ /r/ /o/ /t/ /E/ /c/ /t/ (Snow, Burns, & Griffin, 1998).

Poor phonological awareness has been implicated as the core problem responsible for difficulties in the acquisition of the alphabetic principle, word recognition and identification (Shaywitz & Shaywitz, 2003) and the single best predictor of risk for early reading failure (Uhry, 2005). However, to provide perspective, "longitudinal research has shown that phonological awareness is *necessary, but not sufficient* for becoming a good reader" (Torgesen & Mathes, 2000, p. 5); it is one piece of the reading puzzle.

The highest level of phonological awareness was briefly referred to above and is called phonemic awareness. The focus here is on the phoneme, or single speech sound, therefore phonemic awareness is the ability to perceive and manipulate individual sounds. For example, *sheep* is composed of three phonemes /sh/ /ee/ and /p/ (example provided by Mather & Wendling, 2012 p. 79). Of all the phonological awareness skills, the ability to demonstrate phonemic awareness has been found to be the most critical skill related to early reading (Pennington, 2009; Uhry, 2005).

Instruction in this area can consist of phoneme comparison, phoneme deletion, phoneme segmentation, and phoneme blending. Being explicit about the connection between phonemic awareness skills and reading also strengthens training effects. It is essential to teach letters as well as phonemic awareness to beginners. Phonemic awareness instruction is more effective when children are taught to use letters to manipulate phonemes instead of pictures or other symbols. This is because knowledge of letters is essential for transfer to reading and spelling. Thus, if children do not know letters this needs to be taught along with phonemic awareness.

The NRP identified 52 studies that met their criteria for phonemic awareness studies. Ninety-six treatment-control group comparisons were derived, and the data

were then entered into a meta-analysis to determine treatment effect sizes. The results indicated a large overall effect size on phonemic awareness outcomes, 0.86; moderate effect size on reading outcomes, 0.53; and moderate effect size on spelling, 0.59 (NICHD, 2000). Effects were significant for word reading, pseudoword reading, and reading comprehension skills on both standardized tests, as well as experimenter-devised tests. Furthermore, effects were significant on follow-up tests after several months. These findings suggest that teaching children to manipulate phonemes is critical. The panel concluded that phonemic awareness instruction is effective in teaching not only phonemic awareness skills, but in helping students learn to read.

The NRP provided the following caveat regarding implementing phonemic instruction in the classroom: phonemic awareness training does not constitute a complete reading program and is "a means rather than an end". Exactly how phonemic awareness instruction should be taught by teachers in their classrooms has not yet been clearly specified by the research, nor has the amount of training in phonemic awareness needed been determined.

Phonics. One of the early foundations of reading is the concept that letters and letter combinations represent individual sounds in written words, known as the alphabetic principle (Florida Center for Reading Research [FCRR], 2012). Ehri's (1998, 2000) work emphasizes the importance of the alphabetic principle. He identified four overlapping phases in alphabetic knowledge that develop as children learn to read by sight. (Mather & Wendling, 2012). In the earliest period, the *pre-alphabetic* phase, children do not yet form the letter-sound connections required to read words due to their limited knowledge of the alphabetic system. Any word reading completed during this time is suspected to be the result of remembering selected visual features, such as remembering *look* by the "two eyeballs" in the

middle or *camel* by the "humps" in the middle (Gough, Juel, & Griffith, 1992). Progression into the *partial alphabetic* phase is said to occur when children learn the names or sounds of alphabet letters and use these to remember how to read words. This phase is somewhat limited because children typically only form connections between some of the letters and sounds present in words. For example, children are likely to form connections between the more easily detectable first and final letter sounds of a word and therefore may confuse the similarly spelled words such as *spoon* and *skin* (Savage, Stuart, & Hill, 2001). *Full alphabetic* readers have established complete connections between the letters and their sounds, and as a result can pronounce unfamiliar words as long as they are phonetically regular. The final phase, *consolidated alphabetic*, is characterized by the ability to store letter patterns found in many words; such units include morphemes, or small units of letter sounds, (e.g., -ed for past tense), syllables (e.g, -dle in candle), onsets (e.g., st- in sting), and rhymes (e.g., the –ing in sting) (Mather & Wendling, 2012). Recognizing such chunks makes it easier to read and spell multisyllabic words (Ehri, 2000). In sum, the advanced knowledge of alphabetics enables more rapid and less effortful reading.

Phonics instruction teaches the relationships between letters and the sounds they represent to decode unfamiliar words in text. It encompasses teaching students the basic correspondences between letters and sounds, how to blend sounds together to make words, and how to use these skills while reading text. As students advance from learning simple correspondences between single letters and sounds, they progress to work with initial and final consonant blends and various vowel combinations, and eventually on to larger chunks of letters in words (Torgesen et al., 2007) The efficient use of phonemic decoding skills enables good readers to identify unfamiliar words.

Direct systematic phonics instruction as been emphasized by instructors since the early 1900s (Clark & Uhry, 1995; Gillingham & Stillman, 1960). Chall's (1967) study marked the first phonics research endeavor, which subsequently sparked a number of studies affirming the effectiveness of phonics (Foorman & Torgesen, 2001). The NRP (2000) meta-analytic review reaffirmed these findings but extended the research to highlight the significance of preceding and integrating phonics instruction with instruction in phonemic awareness and the links among phonemes and graphemes. Their meta-analysis revealed that systematic phonics instruction produces significant benefits for students in kindergarten through 6th grade and for students with reading disabilities regardless of socioeconomic status. The impact is strongest in kindergarten and first grade. Phonics knowledge, however, is not enough as it must be integrated with instruction in phonemic awareness, fluency, and comprehension in order for students to become proficient readers.

Oral reading fluency. Oral reading fluency refers to a reader's ability to read text aloud with appropriate rate, accuracy, and prosody. Accuracy and rate measure how correctly and quickly a person reads. Prosody refers to an individual's ability to read with proper expression, intonation, and phrasing; this element of fluency sets it apart from simple automaticity (FCRR, 2012). Prosody often includes attending to punctuation marks, utilizing appropriate timing and phrasing, and using expression that helps convey the meaning of the text; the reader "sounds natural, as if they are speaking" (Armbruster, Lehr, & Obsorn, 2001, p. 22). Fluency is often measured in an oral reading format due to it having more integrity than its silent reading alternative, which also does not allow for the assessment of prosody (Mather & Wendling, 2012).

In order for students to become fluent readers, they must first become accurate; therefore, fluency development is dependent on an adequate foundation of

phonemic awareness and phonics. It is widely accepted that people with reading disabilities expend much of their energy and effort toward word identification, often resulting in decreased reading rate and difficulties with prosody (Mather & Wendling, 2012). As one would expect, this expenditure also negatively impacts these individuals' capacity to comprehend the material they are reading. The implications of not achieving fluency were stated by the NRP: "students who do not develop reading fluency, regardless of how bright they are, are likely to remain poor readers throughout their lives" (2000).

The NRP (2000) analyzed 30 studies related to two instructional methods used at a range of grade levels that both focus on student reading practice and are commonly used in classrooms to establish reading fluency: repeated oral reading practice with guidance and feedback and independent silent reading. The former requires a student to orally read a passage several times, with explicit support and immediate corrective feedback from a fluent reader. This is in contrast to independent silent reading, which encourages students to read extensively on their own with minimal guidance and feedback. Researchers ultimately concluded that repeated oral reading practice with feedback and guidance was an effective strategy for bolstering reading fluency, whereas independent silent reading was not (NRP, 2000).

Guided repeated oral reading requires a student to orally read a passage several times, with explicit guidance and immediate corrective feedback from a fluent reader (Osborn, Lehr, & Hiebert, 2005). This guidance and feedback can come from peers and parents, as well as teachers. Evidence indicates that repeated oral reading helps to improve the reading ability of typically developing readers until at least the fifth grade. It also helps struggling readers at higher grade levels (NRP, 2000). In order to generate a global effect on fluency, guided repeated oral reading

will need to be reinforced over time. It is critical that reading is as accurate as possible, feedback is swift and explicit, and lastly the text should be meaningful and at the appropriate difficulty level.

In regard to remediating deficits, fluency is more difficult to remediate than most other reading skills (Hulme & Snowling, 2009). Reading fluency can be improved but dysfluency is a highly stable characteristic and there will likely always be a gap in fluency compared to their peers (Landerl & Wimmer, 2008; Mather & Wendling, 2012; Torgesen, 2007).

Vocabulary. Vocabulary, or the ability to define words is an integral component of any activity that involves language. Vocabulary is often an indicator of verbal cognitive ability as the knowledge of word meanings usually goes beyond simple definitions and includes an awareness of associated knowledge (Shanahan, 2005).

Vocabulary instruction should provide students with an understanding of the meaning and use of words. Vocabulary is important to reading comprehension because it is obviously difficult to understand what is being read if the student does not know what most of the words mean. In their study, the NRP was not able to conduct a meta-analysis because a substantial amount of the published studies did not meet methodological criteria. However, 50 studies describing a total of 21 different instruction methods were reviewed for trends across studies. They determined that effective vocabulary instruction includes both direct and indirect methods (NRP, 2000). Direct methods include explicitly teaching specific words and word-learning strategies. Indirect methods focus on learning words and their meanings through discussions, independent reading, and listening to someone else read.

Comprehension. The NRP indicated that comprehension is an active process that requires an intentional and thoughtful interaction between the reader and the text (NRP, 2000). The goal of reading is to ultimately understand the information communicated by the print. This becomes particularly salient around the third to fourth grades, when the shift commonly referred to as "from *learning to read* to *reading to learn*" takes place and students are required to possess the reading skills necessary to extract new meaning and learning from text in a predominately independent manner.

The NRP described vocabulary as another essential research theme of reading comprehension skill development: "Reading comprehension is a complex cognitive process that cannot be understood without a clear description of the role that vocabulary development and vocabulary instruction play in the understanding of what has been read" (Snow, Burns, & Griffin, 1998, p. 13). Researchers have provided reliable evidence that typically developing readers acquire vocabulary primarily though independent reading (Nagy & Anderson, 1984; Nagy, Herman, & Anderson, 1985). That said, it takes multiple encounters with a new word to learn it and students with reading disabilities likely need significantly more repetitions (McKeown, Beck, Omanson, & Pople, 1985; Stahl & Fairbanks, 1986). Unfortunately, struggling readers tend to avoid reading, resulting in what has been termed the "Matthew Effect" by Stanovich (1986), wherein "the word-rich get richer, and the poor remain at a linguistic disadvantage" (Ebbers & Denton, 2008, p. 90)

Children's appreciation for increasingly sophisticated language facilitates their ability to engage in more complex analyses of the information within the text. For example, when sharing a book with an adult, children shift from focusing on naming pictures to asking questions about the content of the story (i.e., flipping through the pages of a book and only pointing to pictures and naming the objects before

demonstrating an understanding of the overall story development throughout the book). Next, readers can begin to consider abstract ideas ("What if…" or "Why did…"). Contemplating such questions can be an intervention aimed at increasing reading comprehension when an adult poses these questions and a child learns to think about the text they are reading in this manner.

Increasing explicit instruction and support for the use of comprehension strategies are the most widely cited current recommendation for improving reading comprehension in all students (Block & Pressley, 2002; Dole, Brown, & Trathen, 1996; Lysynchuk, Pressley, & Vye, 1990; NRP, 2000). A comprehension strategy can be any activity a reader employs that enhances comprehension, such as internal thought processes, conversations, or consulting outside references. Effective comprehension strategies also include the use of graphic and semantic organizers, question generation, summarization and paraphrasing, selective rereading, and active comprehension monitoring (Torgesen et. al, 2007).

Spelling. Although not a prerequisite reading skill, spelling is closely related to word reading in that it employs many of the same skills, but in reverse; instead of examining letters in print to gain an understanding of a word, spellers use their understanding of a word to *produce* letters in print. Good spellers are always good readers, but the reverse is not always true (Hosp, Hosp, & Howell, 2007). Furthermore, poor spelling is an indicator of dyslexia not only during childhood but across the lifespan (Mather & Wendling, 2012).

Similar theories of spelling development have been presented by Gentry (1984), Ehri (1989), and Henderson (1990). Although there are some differences across theories, simpler models are typically based on five stages: precommunicative, semiphonetic, phonetic, transitional, and conventional (adapted from Mather & Wendling, 2012). Children in the *precommunicative* stage produce

scribbles or strings of the few letters they know how to write in order to represent words or sentences. During the subsequent *semiphonetic* stage letter choices may violate spelling conventions, but they are logical in that they indicate some knowledge of letter-sound correspondences (e.g., "pl" for pickle or "yuf" to spell wife). Next, at the *phonetic* phase children demonstrate a more thorough understanding of phoneme-grapheme correspondence and they are able to produce spellings that contain letters for all the sounds in words. There is often an overreliance on sounds and a disregard for orthographic patterns such as prefixes or suffixes (e.g., "wavd" for "waved" in this phase). The following *transitional* phase is characterized by more awareness of orthography and a focus on chunks of words, which makes it easier for children to spell larger words correctly. In the last *conventional* phase, one regularly utilizes multiple strategies for spelling including phonology, orthography, and morphology.

Effective spelling instruction increases a student's understanding of orthographic and morphological awareness, two underlying linguistic skills. Both constructs are correlates and predictors of reading and spelling skills (Berninger & May, 2011; Mather & Wendling, 2012). Orthographic awareness has been simply defined as an understanding of how print works and how it looks; it addresses the visual representations of language including letters, letter patterns, words, numerals, and punctuation marks (Mather & Wendling, 2012). Bowers et al. (1994) proposed that beginning readers who are slow to identify individual letters in a word may not activate the letters in memory close enough in time to encode the letter combinations that occur most frequently in print. Hence, these children will not gain knowledge of the orthographic patterns or form orthographic representations of words as easily as their counterparts with rapid letter identification. Morphological awareness refers to one's ability to recognize, understand, and utilize meaningful

units of words. Base words, word roots, prefixes, suffixes, and grammatical inflections are all morphemes that can be added or taken away from a word to alter its meaning. Morphological knowledge enhances awareness of the spelling system and meaningful parts of words, which facilitates both decoding and vocabulary development (Mather & Wendling, 2012). Research demonstrates the importance of early phonological, orthographic, and morphological constructs and their interrelationships; children with or without learning disabilities benefit from instruction in all three areas (Berninger & Fayol, 2011; Berninger, Raskind, 2008; Beringer & Wolf, 2009).

Ehri (2001) argues that spelling should be explicitly taught early on instead of expecting that spelling will develop as a byproduct of learning to read. The authors suggest that, since teaching phonics can be difficult and frustrating for a novice reader, teachers should encourage their students to invent phonetic spellings of words. This "inventive spelling instruction" can teach students how to start considering phonetic spelling much sooner during literacy development prior to sounding out and blending. When older students are struggling with spelling, it is critical to identify whether the breakdown is occurring due to phonological or orthographic weakness in order to select an appropriate intervention (Mather & Wendling, 2012). Spelling errors that demonstrate an overreliance on phonetic spelling indicate poorly developed orthography, whereas spelling errors that are dysphonetic point to an under-reliance on phonology. For students with underdeveloped orthographic skills, interventions should focus on instruction in typical spelling patterns and words with irregular elements. In order to help students who are not utilizing phonetic skills, or are utilizing them incorrectly, teachers should provide both explicit instruction/review of any sound-symbol confusions and practice ordering the sounds in words into the correct sequence.

Wilson Reading System

The *Wilson Reading System (WRS)* aims to improve reading ability for students who lag behind their peers by providing an intensive program that includes the previously discussed empirically validated strategies of instruction in (a) phonemic awareness, (b) explicit and systematic phonics, (c) repeated oral reading practice with feedback and guidance, (d) vocabulary that is direct and indirect, and (e) comprehension strategies.

Background and development. Dr. Samuel Orton was a psychiatrist and neuropathologist who studied "word blindness," a term previously used to describe an absent or defective visual memory for words, and he was the first to suggest that this phenomenon may be due to brain differences rather than brain damage (Mather & Wendling, 2012). In 1925 Orton began addressing the type of remedial instruction that would be most beneficial for children experiencing reading difficulty, advocating for "extremely thorough repetitive drill on the fundamentals of phonic association with letter forms" (p. 614). With the assistance of Anna Gillingham, a psychologist, and Bessie Stillman, a remedial reading teacher, he organized Orton's principles into a remedial approach to teaching English language structure through the use of multisensory phonics instruction. Their multisensory approach attempted to employ as many senses as possible when teaching words and their structure. Later coined the "Orton-Gillingham approach", instruction typically utilized the following sequence: 1) displaying a specific letter, 2) the teacher verbally stating the letter name, 3) the student repeating the letter name, 4) the teacher modeling the written formation of the letter, 5) the student tracing over the teacher's model, 6) the student copying the word and then 7) the student independently writing the word from memory. The student also practices orally reading passages they are able to decode. Instruction becomes more complex as letter names and sounds are

mastered, followed by the introduction of blending, long vowel sounds, and the ”vowel consonant –e” spelling pattern (Orton, 1966).

Barbara Wilson, a former student of the Orton-Gillingham multisensory approach, founded the *Wilson Reading System (WRS)* in 1988. Wilson Language Training Corporation currently offers a tiered system of variety of professional development and reading/spelling curricula packages. Published in 2002 with a second edition in 2012, Wilson *Fundations* facilitates prevention and early intervention efforts in students in kindergarten-3rd grade. *Wilson Just Words*, published in 2009, serves as a second tier intervention for students in grades 4-12 with word-level deficits; the program aims to give these individuals an opportunity to become fluent, independent readers and provides reading/spelling “basics” for older students. *Wilson Fluency/Basic* was published in 2007 and is supplemental to any of the Wilson packages: it provides explicit fluency instruction and reading practice.

***WRS* program.** The most intensive package that Wilson offers, *WRS,* is designed for students in grades 2-12 and adults who are not making sufficient progress in intervention or who may require more intensive instruction due to a language-based learning disability (Wilson Language Training Corporation, 2010a). The *WRS* is an intensive structured program that contains multiple components of established instruction strategies (Adams, 1994; Mather & Wendling, 2012; Snow, Burns, & Griffin, 1998; Torgesen et al., 2001). The *WRS* and is built on a foundation of Orton-Gillingham principles and continues to utilize the explicit, sequenced, and multisensory phonics instruction with intensive segmenting and blending drills (Mather & Wendling, 2012; Shaywitz, 2003; Torgesen et al., 2006). In the intensive model of implementation, a Wilson certified instructor provides small group instruction to students. *WRS* principles include the use of instruction through

modeling that is taught to mastery with multiple opportunities to practice with feedback, and lastly the program utilizes diagnostic planning and teaching.

The *WRS* provides instruction that is well organized, incremental, and cumulative through a 12-step system: (Steps 1-2) the student learns to blend and segment up to six sounds in a closed syllable; (Step 3) focus is on decoding and encoding multisyllabic words; (Steps 4-6) the vowel-consonant-e syllable, open syllable, consonant-le syllable, and suffix endings are taught; (Steps 7-12) advanced word analysis, spelling, vocabulary development, comprehension, and metacognition are taught (Mather & Wendling, 2012).

The *WRS* is aligned with current reading research in that it employs all five NRP components of effective instruction strategies (NICHHD, 2000): phonemic awareness instruction, explicit systematic phonics instruction, repeated oral reading practice with feedback and guidance to address fluency, direct and indirect vocabulary instruction, and comprehension strategies instruction. A report from the Education Commission (1999) stated that, "the Wilson program incorporates five elements for teaching at-risk populations by: Providing direct teaching of alphabetic code, providing direct instruction in language analysis, teaching reading and spelling in coordination, including intensive instruction, teaching for automaticity" (p. 1-2).

From the beginning, phonemic segmentation and blending are emphasized; students use sound cards to learn a unique "sound tapping" procedure that facilitates segmenting sounds within words. Students are taught to say each sound while tapping a different finger, starting with their index, to their thumb. For example, in teaching the word "sad", three letter cards representing the three sounds in the word are placed in front of the student. The student then begins by tapping their index finger to thumb while saying /s/, followed by tapping their middle finger to thumb while saying /a/, and then tapping their ring finger to thumb while saying /d/. Lastly,

the student says the word "sad" as they drag their thumb across all three fingers used (Wilson Language Training Corporation, 2011). *WRS* phonics instruction is developmentally appropriate and moves from initial presentation of initial phonemes, short vowels, and double consonants to words with four or more sounds, and lastly to polysyllabic words. All the while, students read and spell words in both oral and written formats. Spelling instruction is also included in every *WRS* session and incorporates quick drills, teaching/review of concepts, and written dictation work.

In order to address fluency, students read and reread wordlists, sentences, and stories, and complete timed fluency drills. Students also practice listening and reading along with the teacher in addition to using a penciling technique to address prosody; this involves encouraging the student to read selected groups of words by "scooping" a series of words together with a pencil. Before text reading activities, vocabulary words are introduced. Also, a review of the previous lesson's vocabulary is included in every session.

Comprehension is taught from the beginning through the use of visualization techniques; students break down stories into smaller units and practice linking words with a picture in their minds, then students are asked to visualize the story in their heads while one student retells the story. More complex comprehension skills are targeted when the teacher reads aloud from other materials such as newspapers, magazines, and short stories that surpass the students' decoding skills, while encouraging the same process of visualization and retelling.

***WRS* research.** The *WRS* has been cited as an effective intervention by several authorities (Clark & Uhry, 1995; Mather & Goldstein, 2001; Mather & Wendling, 2012; Shaywitz, 2003), and it is used in thousands of schools nationwide (Wilson Reading System, 2012). Despite these endorsements, robust research support is limited due to weak research designs.

This is demonstrated by two installments of the widely referenced Intervention Report created by What Works Clearinghouse (WWC). WWC is the product of the U.S. Department of Education's Institute of Education Sciences (IES) initiative and is a nationally recognized source of scientific evidence for "what works" in education. In order to meet evidence standards, a study has to be a randomized controlled trial or a quasi-experiment with one of the following designs: quasi experiment with equating, regression discontinuity designs, or single-case designs.

In WWC's (2007) report focusing on beginning reading, one study using the *WRS* met the clearinghouse's evidence standards: a randomized controlled trial conducted by the Torgesen et al. (2006). This study is notable for its strong research design and its inclusion in an interim report to the U.S. Department of Education's IES. Researchers used data from four different interventions, including WRS, collected during the 2003-2004 school year for third and fifth grade struggling readers across 27 Pennsylvania school districts. One hundred sixty-two students received a 50-minute *WRS* lesson every school day that, at the researchers' request, was modified to include only word reading instruction (comprehension and vocabulary components were omitted). The *WRS* intervention demonstrated statistically significant improvement on word reading and pseudoword reading measures of the Woodcock Reading Mastery Tests- Revised (WRMT-R) (Woodcock, 1998) for third graders, but not for fifth graders. While the WWC confirmed the statistical significance of improvement in alphabetics, no significant fluency or reading comprehension effects were established. In general, the 2007 WWC beginning reading report considered the extent of evidence for *WRS* to be small for alphabetics, fluency, and comprehension.

The WWC's (2010) most recent installment reported on *WRS'* efficacy with students with learning disabilities. The report indicates that no studies of the *WRS*

currently meet WWC's evidence standards. Design issues were found in many of the studies in that *WRS* intervention was not a not a primary analysis of intervention effectiveness and/or researchers did not use a comparison group.

In their final report prepared for IES, Torgesen et al. (2007) followed up their earlier study (Torgesen et al., 2006) by examining the data previously obtained for the third and fifth graders in conjunction with scores from the end of the following year, when the students were fourth and sixth graders (referred to as the 3rd and 5th grade cohorts, respectively). Findings revealed that the 3rd grade *WRS* cohort showed significant improvement on measures of word reading and pseudoword reading, both timed and untimed, and the 5th grade cohort demonstrated significant improvement on the untimed pseudoword reading task only. It is important to mention again that *WRS* instruction provided in this study was atypical in that it lacked comprehension and vocabulary components. This otherwise extensive study did not meet the protocol for the 2010 WWC report on effective interventions for learning disabled students because the sample was not made up of at least fifty percent of students with learning disabilities.

A number of other studies were listed, but not included, in WWC's 2007 and 2010 reports. One such study did not meet the WWC's criteria due to the absence of a comparison group, but nonetheless demonstrated effectiveness: Wilson and O'Connor (1995) evaluated 220 third through twelfth grade students receiving two to three one-on-one lessons per week throughout the school year. Student performance before and after the *WRS* instruction was analyzed on the Wilson Reading System Test, as well as on the Woodcock Reading Mastery Tests (WRMT) and WRMT-R (Woodcock, 1973, 1998). The WRMT and WRMT-R both include three subtest measures of word reading, pseudoword reading, and passage comprehension. The two word reading subtests comprise the Basic Reading Cluster and all three subtests

contribute to the Total Reading Cluster. Paired t-tests of pre- and posttest scores revealed significant gains for Word Attack, Passage Comprehension, and Total Reading comparisons on both the WRMT and WRMT-R, and for spelling on the *WRS* test.

In an unpublished report, Dr. Frank Wood (2002) of the Wake Forrest University School of Medicine assisted Wilson in the analysis of pre- and post- data that spanned a year of intervention. WRMT data was collected for 405 students in grades three to eight from multiple sites across the United States. Results indicated significant improvement on all of the WRMT subtests and clusters. Furthermore, this improvement was seen across all grade levels and in a subgroup of 40 students from three inner city schools. It is not explicitly stated why this study was ineligible for WWC's 2007 report, although after a review of WWC's protocol, it appears as though the study did not meet the appropriate population parameters; the 2007 report focused on "beginning reading" interventions and focused only on students in kindergarten through third grade. It is known that this study was ineligible for the 2010 report due to an inability to confirm that at least half of the students had a learning disability.

Moccia (2005) examined the differences in reading skill improvement between two groups of middle schoolers: a group of 47 students who participated in special education reading support with no specialized curriculum, and second group of 37 students who received *WRS* instruction. Both groups received 80 minutes of their respective reading instruction for one year. Significant improvement on measures of pseudoword reading and comprehension was demonstrated for both groups. Fluency improvement was not significant and there were no statistically significant differences between special education support and *WRS* groups. This study's design

was problematic due to its failure to use equivalent intervention and comparison groups.

Reuter (2006) conducted a WRS effectiveness study as part of a dissertation. Twenty-six students in a rural middle school with reading disabilities in grades six through eight were included; half of the students received *WRS* and the other half served as a control group. When compared to controls who continued to receive their regular reading instruction, the experimental group did not demonstrate significant improvement on measures of word reading, pseudoword reading, oral fluency, or comprehension. The lack of statistical significance was attributed to the small sample size. Two factors made this study's research design problematic: (a) students receiving the *WRS* intervention were pulled from their regular language arts instruction so the intervention was not purely supplemental, and (b) the teachers in the control group used a variety of instructional techniques and one of them had completed *WRS* certification so it cannot be assumed that students in the control group did not receive some form of *WRS* instruction.

Studies using *WRS* with older age groups are not uncommon since the program developed with adult struggling readers in mind. A study of 24 dyslexic college students at Marshall University (Guyer, Banks, & Guyer, 1993) linked spelling improvement to participation in *WRS.* In groups of two to three students, participants were provided with two 60-minute lessons per week over a 16-week period. Significant improvement in spelling performance was found on the Wide Range Achievement Test-Revised (Jastak & Wilkenson, 1984) for the group receiving *WRS*. This contrasts with no significant change in the other two groups who received a nonphonetic intervention and the control group who did not receive any intervention. Gustavson & Watson (1995) also studied the use of the *WRS* with adults; following six weeks of instruction, reading grade equivalents for words in

isolation progressed from 0.7 to 1.7 on the Slosson Oral Reading Test (Slosson & Nicholson, 1990). Lastly, Brupbacher (1999) reported favorable gains with *WRS* in his case study of the literacy development of two adults with dyslexia.

Two studies primarily examining professional development included evaluations of *WRS*. In their investigation of the effectiveness of a staff development plan, Edgerton (2000) analyzed the reading skills of 11 elementary and 11 middle school students in western North Carolina before and after receiving *WRS* instruction. Measures of word reading, pseudoword reading, and letter-sound production from the Wilson Assessment of Decoding and Encoding (WADE) (Wilson, 1998a) were used as outcome measures, as well as an assessment of auditory analysis skills. The measures were given in December 1999 and again in May 2000, during which students received an undisclosed amount of *WRS* instruction. Significant student score improvement was found in all four areas. The second study focused on prevention versus remediation and used four different elementary reading programs for different levels of impaired readers, including *WRS* for the students who demonstrated the most impairment (Dickson & Bursack, 1999). Since the focus of the study was primarily on the implementation of a 3-year professional development program, student outcomes were somewhat of a sidebar and were not studied well. The authors admit, "Our concern in this project was professional development, not experimental control" (pp. 200). The teacher who employed *WRS* omitted the word reading instruction component of the instruction, because, "the new idea of teaching reading using reading materials that had no pictures and that utilized phonetically controlled vocabulary did not merge with her idea of what works for teaching reading" (pp. 199). Some qualitative comparisons were given, though none addressed the efficacy of *WRS* independently or in comparison to the other interventions.

WRS was also evaluated as part of a larger investigation at the Center for Cognitive Brain Imaging at Carnegie Mellon University; *WRS* was one of four programs selected to examine the impact of intensive remedial instruction on the brains of fifth graders. Using *f*MRI, results indicated that with intensive remedial instruction, the brain of a poor reader can be permanently rewired to function similarly to that of a good reader (Meyler, Keller, Cherkassy, Gabrieli, & Just, 2008). Twenty-three poor readers were compared to nine good readers on timed sight word and pseudoword reading tasks prior to and following 100 hours of intervention, and again one year later. Although poor readers obtained significantly lower reading scores than good readers initially, the performance gap was diminished by half following the intervention and this gain was maintained a year later. This trend corresponded with significant and enduring changes in brain function among the poor readers; poor readers demonstrated significantly increased activation in the left angular gyrus and the left superior parietal lobule. This activation also continued to increase in this group one year after the instruction. Also noteworthy, the poor readers demonstrated a more effortful and focused reading strategy. This suggests that the poor readers had to employ more attention and effort to successfully utilize the intervention skills they were taught. Differences among the interventions had negligible impact on reading performance or brain activity findings, so data from all four instructional groups were combined for analyses. Using the same data, Keller & Just (2009) conducted another study using diffusion tensor imaging (DTI). When compared to good readers, poor readers demonstrated significantly decreased microstructural organization in a region of the left anterior centrum semiovale prior to reading instruction and a significant increase in the microstructural organization in the same region following the 100 hours of intervention. Findings suggest that

myelination, which increases the speed at which impulses move along neuron fibers, had increased.

Other works cited as ineligible for review in the WWC's reports were not primary analyses of *WRS* intervention effectiveness, such as a resource guide (Irvin, 2006; Education Commission of the States, 1999), instruction on how to utilize *WRS* (Wilson, 1996, 1998b), a book chapter about learning disabilities (Moats, 1998), and a brief report on *WRS* by FCRR that did not involve any new research (Johnson, 2004). Even less research-based were a magazine article (Lord, 2005) and a commentary in a journal for librarians whose only mention of *WRS* is a brief anecdotal description of *WRS* "success" in literacy programs run at libraries in Chula Vista and San Jose, California (Gorman, 1997). Such a wide variety of sources discussing *WRS* speaks to the presence of the reading program in a number of institutions across the country.

Given the multitude of education agencies that are employing *WRS* and the number of students in need of an efficient intervention, it is important to verify the program's effectiveness. The purpose of this study is to evaluate the effectiveness of *WRS* instruction on student reading and spelling achievement. This will be accomplished by addressing the following two research questions:

Research Questions & Hypotheses

Research Question 1. Does the *Wilson Reading System* significantly improve reading achievement as measured by (a) word reading, (b) pseudoword reading, (c) reading fluency, and (d) a cluster of basic reading skills?

Hypothesis 1. The expectation is that students will demonstrate significant improvement on all reading achievement measures, with the exception of reading fluency; since the *Wilson Reading System* intervention was only provided for one

month, it is hypothesized that there will not be notable fluency gains evident in such a short time period.

Research Question 2. Does the *Wilson Reading* System significantly improve spelling achievement as evidenced by (a) word spelling, (b) pseudoword spelling, and (c) a cluster of phoneme/grapheme knowledge?

Hypothesis 2. Since the *Wilson Reading System* includes instruction in concepts related to both reading and spelling, as well as explicit instruction in spelling, it is expected that students will significantly improve on all of the spelling achievement measures after receiving the intervention.

Chapter 3

METHOD

Participants

Participant data was obtained from an archival database of 56 students attending the oldest and largest public school district in a southwestern state. At the time of the study (immediately following the 2010-2011 school year) the large urban district served 50,550 students in 125 schools comprised of 61% Hispanic/Latino, 24% White/Anglo, 6% Black/African American, 4% Native American, 3% Asian American, and 3% Multicultural (National Center for Education Statistics, 2012). Approximately 70% of the students received free or reduced lunch.

For the purposes of this study, district special education teachers initially selected students to participate in the intervention based on several criteria: average overall cognitive ability, entering grades 2 – 12, and 2 or more grade-levels behind their peers in decoding and spelling skills. Teachers also attempted to select students who did not have any other disabilities besides reading and who would be available to participate in the entire month long intervention.

Forty-three students, 26 male and 17 female, participated in this study. Their ages at the beginning of the intervention ranged from 7 to 17 years (M = 10.12, SD = 2.42). Any students who were previously labeled as "English Language Learners" subsequently demonstrated English proficiency on state standardized testing. An unknown number of the participants were receiving special education support as students with a reading learning disability, while others were not receiving any special education services. Since the intervention occurred during the summer, the grade levels students were entering that fall were utilized. Grade levels ranged from second to eleventh grades (M = 4.37, SD = 1.62).

Measures

Woodcock-Johnson III Tests of Achievement (WJ-III). The WJ-III was designed by Richard Woodcock, Ed.D., and coauthors Kevin McGrew, PhD., and Nancy Mather, Ph.D. to provide a comprehensive picture of academic functioning in individuals ranging from 2 through 90 years of age. First published in 1977, the third version of this test is the result of advances in research and improved understanding of achievement and test construction (Woodcock, McGrew, & Mather, 2001). In 2007 the norms were updated in order to be in accordance with more current U.S. population characteristics; 8,782 participants from the original sample, including 4,470 individuals in kindergarten through twelfth grade were included in a recalculation based on 2005 Census statistics (McGrew, Schrank, & Woodcock, 2007). The WJ-III has a median internal consistency estimate of .98, with the range of internal consistency estimates ranging from .76 to .97 for individual subtests and from .85 to .96 for the clusters. Test-retest reliabilities have been estimated to range from .69 to .96 for subtest scores and from .93 to .99 for cluster scores. Correlational and confirmatory factor analyses provide support for the WJ-III's validity (Cizek, 2003).

The 22 subtests that comprise the WJ-III are organized into reading, writing, mathematics, oral language, and written language domains. Five subtests from this widely used battery were selected for this study due to their ability to assess different aspects of reading and spelling achievement. Additionally, scores on these subtests enabled the generation of two clusters.

Letter-Word Identification subtest. Students were required to read aloud from a list of 76 increasingly difficult words, assessing their ability to accurately read individual words in an untimed format.

Reading Fluency subtest. Students read increasingly complex isolated sentences, decided if the statement was true, then circle "yes" or "no" for each. They

answered as many of the 96 sentences as possible in the three minute allotted time period. This subtest measured their ability to quickly read simple sentences and indicate an accurate understanding of their content.

Word Attack subtest. Students were asked to read aloud from a list of 32 increasingly difficult pseudowords or nonsense words. This subtest assessed their ability to apply phonic and structural analysis skills in an untimed format.

Spelling subtest. Fifty-nine increasingly difficult words were presented via an audio recording to students and they attempted to spell them in response books, testing their ability write dictated words correctly.

Spelling of Sounds subtest. An audio recording of 28 increasingly complex pseudowords was presented to students and they attempted to spell them in response books, testing their ability to apply regular phonological and orthographical coding skills to write dictated letter combinations.

Basic Reading cluster. This combination of Letter-Word Identification and Word Attack subtests yields the Basic Reading Cluster. This cluster measures students' fundamental reading skills including sight vocabulary, phonics, and structural analysis.

Phoneme/Grapheme Knowledge cluster. This cluster consists of Word Attack and Spelling of Sounds subtests and was used to evaluate students' proficiency with phonic and orthographic generalizations in both decoding (reading) and encoding (spelling).

Procedure

District diagnosticians who were familiar with the WJ-III administered the measures to students in order to obtain a "pre" or baseline measure of students' reading/spelling achievement prior to receiving the *WRS* instruction. The diagnosticians were not involved in the *WRS* intervention procedure.

Participating teachers were all certified in special education (Table 1 provides an overview of teachers' self-reported professional characteristics). Teachers were in the process of obtaining their *WRS* Level I Certification, which requires 90 hours of online instruction and a 60-hour practicum with individual lessons including demonstration, observation, and feedback with a Wilson trainer. The intensive summer training session conducted in June 2010 initially involved 19 teachers. However, two teachers dropped out of the program in the first week. One was excused from the program. This teacher attempted to integrate her own strategies that she had accumulated over her career; the *WRS* training is clear in its requirement that teachers openly and completely adopt the curriculum in order to safeguard fidelity. Another teacher opted out of the program due to personal circumstances. Both discontinued their participation within the first week.

Table 1
Teachers' Professional Characteristics (N=17)

Characteristic	*n*	%
Years of Teaching		
1-5	6	35
6-10	4	24
11-15	2	12
16-20	3	18
21-30	2	12
Highest Degree		
Bachelor's	5	29
Master's	11	65
Educational Specialist	1	6
Special Education Certification		
Cross-Categorical	14	82
Learning Disability	3	18
Emotional Disability	1	6
Mental Retardation	1	6
Endorsement		
Reading	5	29
Bilingual	2	12
Structured English Immersion	5	29
English as a Second Language	3	18

Teachers were expected to demonstrate a sophisticated working knowledge of the sound-symbol system, structure, and use of specific diagnostic techniques. Only after this certification process is completed can the individual be considered trained in the *WRS* (Wilson Language Training Corporation, 2010b). As part of their training, the 17 teachers provided one hour of intervention to three individual students, five days a week for four weeks. Thus, each student received 20 hours of total instruction during the month long intervention.

The day the students finished the month of *WRS* intervention, the district diagnosticians again evaluated the students' reading/spelling achievement using the same WJ-III battery to obtain a "post" measure. Protocols were scored using Woodcock-Johnson Tests of Achievement-III Compuscore and Profiles program (Schrank & Woodcock, 2001), copied, and de-identified by the district.
Following approval from the Arizona State University institutional review board, the protocols were obtained by the researchers for the current study. In order to ensure accuracy, students' raw scores were verified and re-scored using the most updated software, Woodcock-Johnson III Normative Update Compuscore (Schrank & Woodcock, 2007).

Chapter 4

RESULTS

WJ-III reading and spelling standard scores were input into SPSS for statistical analysis. Cases with missing data were detected upon data entry and those cases without pre or posttest data were removed from further analysis; due to difficulty retaining consistent pupil attendance during summertime, complete "pre" and "post" data could only be obtained for 43 students. Before the research questions were addressed, preliminary analyses were conducted to ensure the appropriateness of the proposed statistical models. Univariate distributions and scatterplots were examined and no extreme scores, outliers, or curvilinear relationships were observed. In order to construct a profile of the sample population, descriptive statistics including frequencies and percentages were used to analyze student demographic information and reading/spelling achievement scores. Table 2 summarizes the age and grade composition of the sample.

Table 2
Participant Characteristics (N=43)

Characteristic	n	%
Age (years)		
7	6	14
8	6	14
9	7	16
10	7	16
11	7	16
12	3	7
13	5	12
17	2	5
Grade		
2.0	11	26
3.0	6	14
4.0	9	21
5.0	6	14
6.0	5	12
7.0	3	7
9.0	1	2
11.0	2	5

Inferential statistics, including several Analyses of Variances (ANOVAs), were used to address the research questions. One-way repeated-measures ANOVAs were used to analyze pre- and posttest scores from each of the seven reading/spelling achievement measures (five WJ-III subtests and two WJ-III clusters). Repeated measures ANOVA was selected because "it reduces the unsystematic variability in the design and so provides greater power to detect effects" (Field, 2005, p. 428). Another advantage of repeated measures ANOVA is that it is appropriate for studies with small numbers of participants (Maxwell & Delaney, 2004).

Participating students' reading and spelling achievement was tested prior to receiving *Wilson Reading System* (*WRS*) instruction. After 20 hours of the intervention the students were again tested using the same achievement assessments.

Reading Achievement Outcomes

The first research question examined the efficacy of the *WRS* to improve reading achievement as measured by students' performance on word reading, pseudoword reading, and reading fluency tasks, as well as a cluster of basic reading skills. Table 3 contains a summary of central tendency and dispersion for the reading achievement measures.

Table 3
Reading Achievement Means & Standard Deviations

		Pretest		Posttest	
WJ-III	*N*	*M*	*SD*	*M*	*SD*
Subtest					
Letter-Word Id	43	78.14	15.06	79.12	14.21
Word Attack	43	84.67	10.10	87.28	9.83
Reading Fluency	42	77.00	11.69	76.57	10.97
Cluster					
Basic Reading	43	79.51	13.32	81.47	12.83

In order to conceptualize the distribution of the students' performance before and after the *WRS* intervention, Figure A1 depicts the distribution of all of the pre-

and post-test reading scores in addition to the distribution of the difference scores for each reading pre/posttest combination.

Four one-way repeated measures ANOVAs were used to determine whether a significant difference existed between the means for pre- and post-test reading achievement scores (Table 4).

Table 4
Reading Achievement One-Way Analysis of Variance Summary

WJ-III	*df*	*F*	*p*	η_p^2
Subtest				
Letter-Word Identification	(1,42)	2.86	.098	.06
Word Attack	(1,42)	7.65	.008*	.15
Reading Fluency	(1,41)	.24	.630	.01
Cluster				
Basic Reading	(1,42)	11.23	.002*	.21

η_p^2 = partial eta-squared
*$p < .01$

Word reading. Students' Letter-Word Identification subtest post-test mean score was not significantly greater than their mean score on the pre-test. The effect size ($\eta_p^2 = .06$) is medium, suggesting that the non-significant findings could be due to inadequate sample size.

Pseudoword reading. Students' Word Attack subtest posttest mean score was significantly greater than their mean score on the pretest, $p = .008$. The strength of the relationship between the linear model and the subtest data over time, as assessed by η_p^2, was strong with the linear model accounting for 15% of the variability in trends over time.

Reading fluency. Students' Reading Fluency subtest posttest mean score was not significantly greater than their mean score on the pretest. The presence of a small effect size ($\eta_p^2 = .01$) suggests that the non-significant findings could be due to inadequate sample size.

Basic reading. Students' Basic Reading Skills cluster posttest mean score ($M = 81.47$, $SD = 12.83$) was significantly greater than their mean score on the pretest

(M = 79.51, SD = 13.32), $F(1, 42) = 11.23$, $p = .002$. The strength of the relationship between the linear model and the cluster data over time, as assessed by η_p^2, was strong with the linear model accounting for 21% of the variability in trends over time.

Spelling Achievement Outcomes

The second research question examined the efficacy of the *WRS* to improve spelling achievement as measured by students' performance on word spelling and pseudoword spelling tasks, as well as the cluster of phoneme/grapheme knowledge skills. Table 5 contains a summary of central tendency and dispersion for the spelling achievement measures. In order to conceptualize the distribution of the students' performance before and after the *WRS* intervention, Figure A2 depicts the distribution of all of the pre- and posttest spelling scores in addition to the distribution of the difference scores for each spelling pre/posttest combination.

Table 5
Spelling Achievement Means & Standard Deviations

		Pretest		Posttest	
WJ-III	*N*	*M*	*SD*	*M*	*SD*
Subtest					
Spelling	42	73.33	13.38	72.86	12.68
Spell. of Sounds	41	84.44	13.24	88.83	13.27
Cluster					
Basic Reading	40	83.67	11.43	86.95	11.43

Three one-way repeated measures ANOVAs were used to determine whether a significant difference existed between the means for pre- and posttest spelling achievement scores (Table 6).

Table 6
Spelling Achievement One-Way Analysis of Variance Summary

WJ-III	*df*	*F*	*p*	η_p^2
Subtest				
Spelling	(1,41)	.24	.630	.01
Spelling of Sounds	(1,40)	14.45	<.001*	.27
Cluster				
Phoneme/Grapheme	(1,39)	13.65	.001*	.26

η_p^2 = partial eta-squared
*$p \leq .001$

Word spelling. The students' Spelling subtest posttest mean score was not significantly greater than their mean score on the pretest. The presence of a small effect size ($\eta_p^2 = .01$) suggests that the non-significant findings could be due to inadequate sample size.

Pseudoword spelling. Students' Spelling of Sounds subtest posttest mean score was significantly greater than their mean score on the pretest, $p < .001$. The strength of the relationship between the linear model and the subtest data over time, as assessed by η_p^2, was strong with the linear model accounting for 27% of the variability in trends over time.

Phoneme/grapheme knowledge. Students' Phoneme/Grapheme Knowledge cluster posttest mean was significantly greater than their mean score on the pretest, $p = .001$. The strength of the relationship between the linear model and cluster data over time, as assessed by η_p^2, was strong with the linear model accounting for 26% of the variability in trends over time.

Summary of Findings

Results of the data analyses led to the following findings regarding student performance on the assessments:

Reading achievement measures:

1. Students demonstrated significant improvement on the Word Attack subtest and Basic Reading cluster.

2. Students did not exhibit significant growth on Letter-Word Identification and Reading Fluency subtests.

Spelling achievement measures:

3. Students demonstrated significant improvement on the Spelling of Sounds subtest and Phoneme/Grapheme Knowledge cluster.
4. Students did not exhibit significant growth on the Spelling subtest.

Chapter 5

DISCUSSION

As a significant number of students in the United States continue to struggle with reading acquisition with detrimental consequences if these skills are not established, identifying effective interventions to address the unique needs of these students is critical. Research has identified the most essential reading elements for students to learn, including phonemic awareness, phonics, fluency, vocabulary, and text comprehension, as well as the most effective instructional components for teachers to convey these skills to include a direct, explicit, and systematic format (NRP, 2000). The current study investigated the student impact of a staff development program that trained teachers to provide such an approach to reading instruction. Specifically, the purpose of this research was to evaluate the initial effectiveness of an intensive program, *Wilson Reading System (WRS)*, in its ability to significantly improve the reading and spelling skills of poor readers after twenty hours of exposure to the curriculum. Students who were identified by their teachers as being behind their peers in reading participated in an hour of *WRS* instruction every weekday for one month. A pre/posttest repeated-measures design was utilized; word reading, pseudoword reading, reading fluency, word spelling, and pseudoword spelling skills were assessed before and again after the *WRS* intervention using five subtests and two clusters from the Woodcock-Johnson III Tests of Achievement (WJ-III; Woodcock, McGrew, & Mather, 2001).

Reading Achievement

The expectation was that students would demonstrate significant improvement on all reading achievement measures from pre- to post-test, with the exception of reading fluency. Results indicated significant growth on the pseudoword

reading task and Basic Reading cluster, but not on the regular word reading or reading fluency activities.

Pseudoword reading. Pseudoword reading skill improvement is commensurate with findings from a number of other studies in which students demonstrated similar gains after participating in the *WRS* (Edgerton, 2002; 1995; Torgesen et al., 2007; Wood, 2002; Wilson & O'Connor). The only instance in which students did not show significant improvement on pseudoword reading was in a study that the failure to find effectiveness was attributed to a notably small sample size (Reuter, 2006). The most apparent explanation for almost all of the existing studies finding a notable gain in pseudoword reading is that the *WRS* strongly emphasizes this skill; the *WRS*'s principal focus is on teaching phonics using their multisensory methods. As previously discussed, phonics instruction teaches the relationships between letters and the sounds they represent in order to decode unfamiliar words in text. The pseudoword reading task required students to apply phonic and structural analysis skills to decode and read aloud from a list of words that were not real words. The reason for using these words is that their unfamiliarity forces readers to rely on these decoding skills. Therefore, it is possible that students demonstrated improvement on pseudoword reading due to the skill being a direct target of the *WRS* intervention.

Regular word reading. Alternatively, students who participated in this study did not improve on regular word reading. This may be related to the short duration of the *WRS* intervention, because Edgerton's (2002) and Wood's (2002) studies found word reading gains on the WRMT after students participated in the *WRS* interventions over the course of a school year. Torgesen et al.'s (2007) large scale study, also conducted over a school year, found that the third grade cohort showed significant improvement on measures of word reading and pseudoword reading, both

timed and untimed, but the fifth grade cohort only demonstrated significant improvement on the untimed pseudoword reading task. These results suggest that there may be an effect of grade level; future research should explore the possibility that students at different grade levels may respond to *WRS* at different rates and/or in a different way. Since this study had so few participants, an analysis of grade level effects was not feasible.

Another potential explanation for the lack of growth in this area is that the measure used to assess word reading may not have been sensitive to the small gains made over the relatively brief intervention. The Letter-Word Identification subtest used to measure basic word reading skills consists of a list of increasingly difficult words that requires students to quickly transition from basic to more complex decoding skills (e.g., from "when" and "must" to more difficult words such as "knew" and "island").

Lastly, the timing of the Letter-Word Identification subtest is another factor that may have negatively impacted students' performance; since the subtest is the first assessment that students completed it presents as a potential confounding variable that, in future studies, should be controlled for through counterbalancing.

Reading fluency. As anticipated, students failed to significantly improve on the Reading Fluency subtest. The absence of notable fluency gains was anticipated because of the short duration of the *WRS* intervention and the minimal amount of focus the program initially places on fluency. Before instruction addressing increasing rate, students must first be accurate readers (Mather & Wendling, 2012); instruction should first emphasize the development of accurate word recognition and analysis skills (Pikulski & Chard, 2005). After students have developed basic decoding accuracy, instructional emphasis can then be placed on reading and rereading a

phrase to make it "sound like talking" (Mather & Wendling, 2012; Stahl & Kuhn, 2002).

It is interesting to note that, not only did students fail to achieve significant growth, but their standard scores, on average, decreased slightly. This is consistent with previous research (Moccia, 2005) and the theory that fluency gains take time because students are likely to exhibit conscious, controlled, strategic processing with new and unfamiliar words, but once skills are practiced to mastery they many times switch from these controlled strategies to a faster, more "automatic pilot" approach (Schneider & Chein, 2003; Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977). Therefore, it would be premature to expect the students in this study to demonstrate gains, given they had only participated in twenty hours of *WRS* intervention. Researchers interested in studying students' response to *WRS* with respect to fluency should utilize a lengthier longitudinal design. Also, with regard to future studies, it is advisable to consider the different types of fluency (e.g., oral and silent reading fluency in different formats such as words/pseudowords, sentences, and passages). This would enable a better understanding of the subtleties of students' fluency gains in response to such an intervention.

Basic reading. Posttest scores on the Basic Reading cluster, which is a combination of Letter-Word Identification and Word Attack subtests, were significantly higher than students' pretest scores. This cluster measures students' fundamental reading skills including sight vocabulary, phonics, and structural analysis. Students also demonstrated significant improvement on the Basic Reading cluster; since this is a combination of the pseudoword and regular word reading tasks, its increase is largely the result of the pseudoword reading skill growth.

In sum, results indicated that students showed significant improvement on the pseudoword reading task but not the regular word reading or reading fluency

activities (or the Basic Reading cluster combining both regular and pseudoword reading). Consequently, the first hypothesis was not substantiated, as only one of the three reading subtests and the cluster demonstrated significantly larger posttest scores.

Spelling Achievement

The second hypothesis suggested that students would significantly improve on all of the spelling achievement measures (i.e., the Spelling and Spelling of Sounds subtests, and the Phoneme/Grapheme Knowledge cluster) after receiving the *WRS* instruction. Results indicated that the students showed significant improvement on the Spelling of Sounds subtest but failed to demonstrate significant improvement on the Spelling subtest. Student performance on the Phoneme/Grapheme cluster, which is the combination of both of these subtests, demonstrated significant growth from pre-test to post-test.

Regular word & pseudoword spelling. Finding significant improvement on pseudoword reading skills, but not on regular word spelling skills is consistent with Young's (2001) study of high school students with reading disabilities who used the *WRS* for three months. In the discussion of these results, Young cites the prevalence of phonetic irregularity of the words in the Spelling subtest of the WJ-III as the main reason that students likely did not show growth on that measure. As in the current study, *WRS* emphasis was placed on the alphabetic principle and the phonetic regularity of English, as irregular spellings are not introduced until the student has a strong foundation in the regular sound-symbol relationships. The students' level and short duration did not allow for instruction to go beyond closed, open, and "silent e" syllables; "vowel r", vowel digraphs, and "consonant-l-e" syllable types were not yet introduced. Therefore, the skills gained by students in this study would not likely be

reflected by a standardized spelling test that contains less phonetically and morphologically regular words.

Students with reading deficits are more likely to make phonetically regular misspellings of irregular words, such as "yot" for yacht, and being unfamiliar with the words does not appear to explain the misspellings (Young, 2001). Baron (1979) found that poor readers make more phonologically accurate errors than the good readers because they fail to use the visual-orthographic information in their vocabularies that they use in reading the same words. When reviewing the spelling protocols obtained for this study, many student errors were phonetically regular. This could be the result of Baron's suggested phenomenon, the *WRS's* initial emphasis on phonetically regular rules and words, or a combination of the two.

Further reason for expecting "treatment resistance" in this area is that spelling skills are acquired more slowly than reading skills, and adults with reading disabilities who have been remediated continue to experience persistent difficulties with spelling (Snowling, Goulandris, & Defty, 1996; Snowling & Hulme, 2011). Although spelling involves many of the same skills as reading, spelling is much more difficult than reading as one has to reproduce the entire word, not just recognize it (Mather & Wendling, 2012); it relies on the integration of phonological, morphological, semantic, and orthographic knowledge (Moats, 1995).

Phoneme/grapheme knowledge. Students evidenced significant improvement on the Phoneme/Grapheme Knowledge cluster, which is a measure of encoding for both regular and pseudowords. Since this score is simply a combination of the Spelling and Spelling of Sounds subtests, the notable growth on this cluster is due to the large effect of growth students demonstrated on the latter.

Results indicated that brief participation in the *WRS* contributed to gains in pseudoword spelling skills but not regular word spelling. The *WRS* intervention

effectiveness was also indicated when student performance on a combination of both subtests into a cluster score was considered. Due to these mixed findings, the second hypothesis that students would demonstrate significant improvement on all spelling achievement measures was not substantiated.

Pseudoword Reading and Pseudoword Spelling

The significant effect of the *WRS* on improving student reading and spelling of pseudowords, compared to its nonsignificant effect on reading and spelling "regular" word growth, suggests that the students in this study responded to the brief intervention in a particular way. As previously discussed, students likely performed better on these tasks because, unlike many regular words, pseudowords always conform to English rules of phonology and these rules are a predominant focus of the early stages of the *WRS*. Interestingly, most individuals with severe and persistent reading disabilities such as dyslexia typically show an opposite pattern of skills than what was observed in this study; those individuals tend to have a pattern of standardized test results of decoding words in list being greater than pseudoword word reading and spelling (Uhry & Clark, 2004). Conversely, the individuals in this study presented with higher pseudoword skills at the onset in addition to growing more in these areas after receiving intervention. One possible explanation for this trend may be that the majority of the students in this study were simply lacking these underlying reading skills versus having an neurological disability such as dyslexia that effects their ability to learn to read. Mather & Wendling (2012) suggest that for individuals who master nonsense words, but struggle with actual words, instruction should focus on orthographic patterns and sight word reading.

Limitations

It is important to address limitations so that the reader can interpret results and conclusions appropriately. Although there was intent to avoid some of the

methodological limitations found in previous research, the nature of archival data limited experimenter control.

Two notable limitations were the absence of a control group and a lack of random assignment. These factors were not controlled for experimentally because the data was collected by the school district independent of and prior to the involvement of the researcher. While the manner in which the study was designed may present with a number of limitations, the internal validity for this experiment is generally believed to be appropriate for a school-based study. The goal was to measure student exposure to the *WRS*; to the teachers' knowledge students were not participating in any other kind of outside intervention that could account for any improvements noted here. Although having the teachers trained in *WRS* during the summer was probably ideal timing for them, the students who participated in this study likely could have benefited more from the intensive program if it was not followed by a long break from structured curriculum (during which the potential for new skill loss is high).

This study took place during a short period of time. This limitation is twofold: (1) student exposure to the *WRS* instruction was limited, and (2) the internalization of language concepts is complex, particularly so for those with persistent deficits in this realm, so progress will take place at a slower rate (Deno, Fuchs, Marston, & Shin, 2001; Shippen, Houchins, Steventon, & Sartor, 2005; Stanovich, 1986). The *WRS* recommends a three year program for students with severe reading deficits (Wilson Reading System, 2012). This study may have been too short to demonstrate the significant progress in the variety of reading/spelling skills assessed here. Additionally, students could realize delayed gains that would not be reflected in this data set.

Effects of the intervention may have been influenced by the fact that student instruction was provided in conjunction with *WRS* training. That said, teachers had just learned the *WRS* and Wilson Trainers were supervising them in their provision of the instruction to the students, so there is the possibility that the intervention could have been given to students with more fidelity to *WRS* protocol than one would expect of a teacher who did not have that supervision and support.

Generalizability of these results to all students with reading deficits is limited due to the use of a relatively small number of participants from a single southwestern school district. This is a common threat to external validity in such studies and a replicated study with a larger number of participants stratified to represent the ethnic and demographic qualities characteristic of a larger region or a national sample could be pursued to alleviate this concern.

With regard to measurement, multiple district diagnosticians assessed the students and the extent to which standardized administration procedures were followed is unknown. There should be some degree of confidence in test administration since diagnosticians were required to have obtained a Master's degree in education and a minimum of five years of assessment experience prior to being hired by the district. It is noteworthy to emphasize that the diagnosticians were not involved in the implementation of the *WRS.* Reliability between examiners and testing environments is also uncertain. Despite these limitations, this study does offer preliminary evidence suggesting the *WRS* may be an effective intervention for struggling readers.

Implications for Practice

Due to demands placed on both educators and students, there is a necessity to "speed up" remediation. Substantial increases are imperative and need to be realized over a short period of time (Stanovich, 1986). The ability of the *WRS* to

produce statistically significant increases despite the short duration, small sample size, and limited sensitivity of the measures suggests that it is a good candidate for reading intervention in the educational setting.

Theoretically, it is important to consider the preference and cost effectiveness of prevention versus remediation. According to Torgesen (2000), it takes more than two hours of intensive intervention per day for a year to remediate the reading skills of a child at the sixth or seventh grade level. Educational institutions should focus more resources on research-based early interventions, as they have been found to be highly effective (Foorman, Francis, Fletcher, Schatschneider, & Mehta, 1998) and they would permit students and their families to sidestep the hardship that accompanies failing to learn how to read.

Future Research

In order to validate the cautious gains evidenced here, additional research should seek to build upon the present study. Longitudinal research including a "business as usual" comparison group, another reading program for comparison, increased sample size, randomized group assignment, and measureable teacher checks for *WRS* compliance during the school year would permit more robust consideration of *WRS* effectiveness. It would be interesting to measure this effectiveness using a variety of assessments already being given in schools such as curriculum-based measurement probes and standardized state tests. Additionally, the variability of ages, grades, and reading skills contained in this study may have concealed important group differences; participant data should be analyzed in smaller groups based on reading ability level to explore if students at different levels respond differently to the intervention. It would be worthwhile to take many of the variables discussed here, such as age, grade, and different types of reading skills, and use exploratory factor analysis to see what patterns emerge from the data; such

a study would potentially reveal if there is a profile of student characteristics that makes them respond better to an intervention such as *WRS*.

Conclusion

Based upon the results of this study, even brief exposure to the *WRS* appears to provide significant notable gains in phonetically regular pseudoword reading/spelling skills. Growth occurred despite this study's short duration, small sample size, and use of achievement assessments that are not sensitive to minor gains. Immediate gains in less phonetically regular words and reading fluency was not observed, but these skills do not typically develop at the same rate and time as the previously mentioned skills. Therefore, it is suspected that eventual gains would be observed with prolonged exposure. In general, findings from this study contribute to the growing body of literature supporting the use of the *WRS* for students who are multiple grade levels behind their peers in reading.

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APPENDIX A

FIGURES

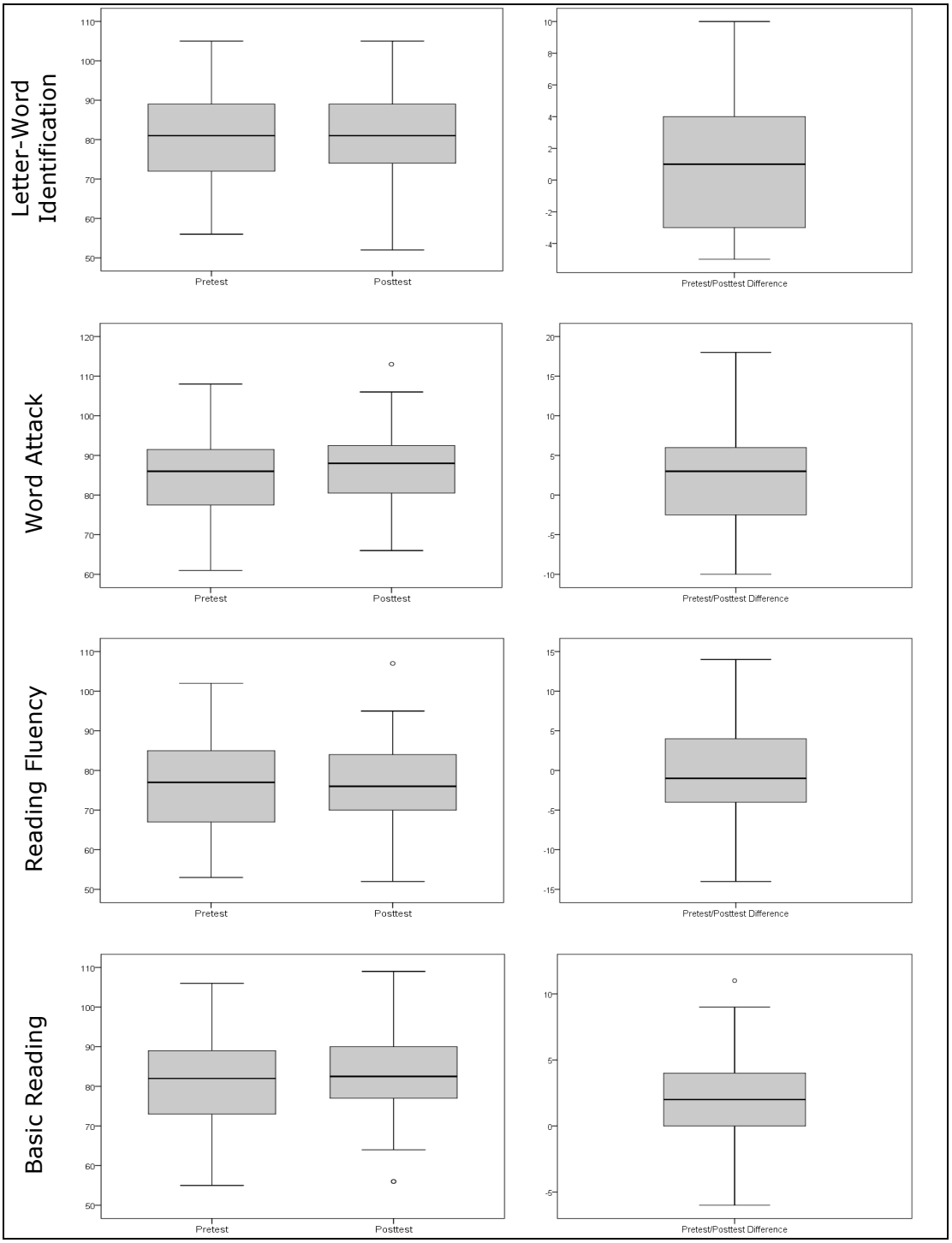

Figure A1. Boxplot of pre- and posttest reading standard scores (left) and boxplot of the difference between the scores (right).

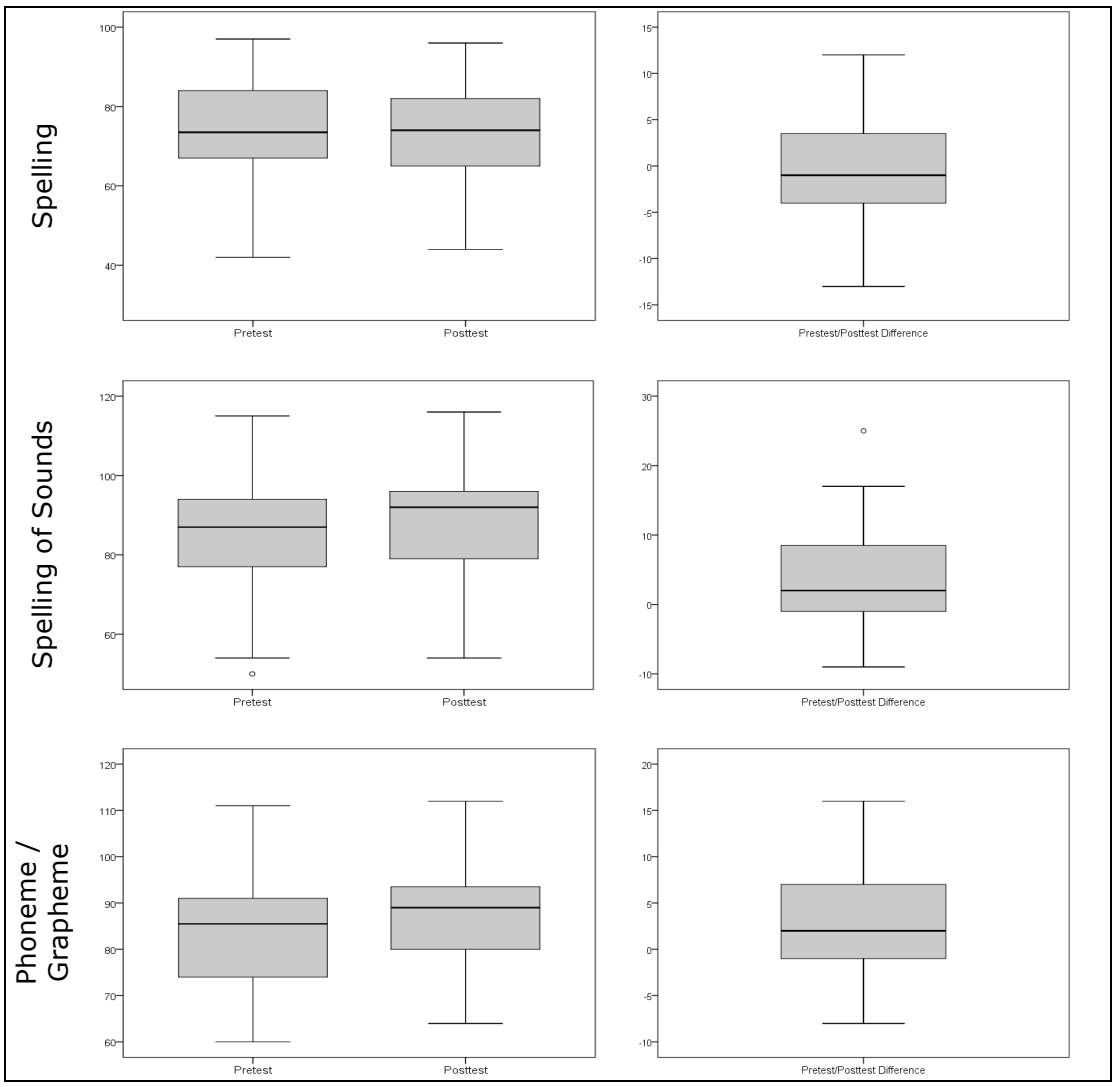

Figure A2. Boxplot of pre- and posttest spelling standard scores (left) and boxplot of the difference between the scores (right).

APPENDIX B

INSTITUTIONAL REVIEW BOARD APPROVAL

ASU Knowledge Enterprise Development

Office of Research Integrity and Assurance

To:	Linda Caterino Kulhavy EDB
From:	Mark Roosa, Chair SM Soc Beh IRB
Date:	09/04/2012
Committee Action:	**Renewal**
Renewal Date:	09/04/2012
Review Type:	Expedited F7
IRB Protocol #:	1107006636
Study Title:	Initial effects of Wilson Reading System on student reading achievement
Expiration Date:	08/29/2013

The above-referenced protocol was given renewed approval following Expedited Review by the Institutional Review Board.

It is the Principal Investigator's responsibility to obtain review and continued approval of ongoing research before the expiration noted above. Please allow sufficient time for reapproval. Research activity of any sort may not continue beyond the expiration date without committee approval. Failure to receive approval for continuation before the expiration date will result in the automatic suspension of the approval of this protocol on the expiration date. Information collected following suspension is unapproved research and cannot be reported or published as research data. If you do not wish continued approval, please notify the Committee of the study termination.

This approval by the Soc Beh IRB does not replace or supersede any departmental or oversight committee review that may be required by institutional policy.

Adverse Reactions: If any untoward incidents or severe reactions should develop as a result of this study, you are required to notify the Soc Beh IRB immediately. If necessary a member of the IRB will be assigned to look into the matter. If the problem is serious, approval may be withdrawn pending IRB review.

Amendments: If you wish to change any aspect of this study, such as the procedures, the consent forms, or the investigators, please communicate your requested changes to the Soc Beh IRB. The new procedure is not to be initiated until the IRB approval has been given.

Please retain a copy of this letter with your approved protocol.